10 - 28

H · B · C · N : O : O : F : Ne :

↑ or →

Practice Problems:

SH_2 — AB_2E_2

SO_2 — AB_2E

SO_3^{2-} — AB_3E

SO_3 — AB_3

SCl_2O — AB_3E

have same shape

ABE formulas:

A is the central atom

B is the number of bonding groups

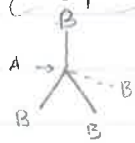
E is the number of electron groups

Four Groups: AB_4

all sp^3 hybrids

CH_4

SO_4^{2-}



non-polar

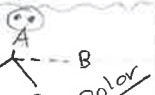
s^1p^3 hybrid ← tetrahedral

109°

AB_3E

NH_4

SCl_2O



Polar

trigonal pyramidal

$\lesssim$ 109° (107°)

AB_2E_2

SH_2

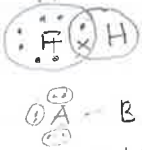
H_2O / OH_2

Bent Polar

$\lesssim$ 109° (105°)

ABE_3

HF / FH



Polar

linear

180°

Polar vs Non Polar bonds -

F - F non-polar bond

electronegativity 4.0 - 4.0

δ^- F - Br δ^+ Polar bond

4.0 - 2.8

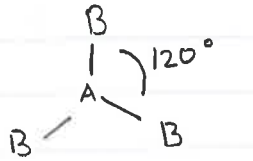
AB_2 : O :: C :: O :

3.5 2.5 3.5

two polar bonds but a non-polar molecule because the bonds cancel each other out

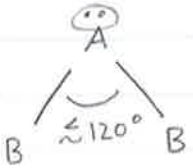
No E group is non-polar, if it does, then it is usually polar. If the molecule is ionic / has a charge it is neither.

Three groups: AB_3 + AB_2E — sp^2 – one p-orbital left over



trigonal planar

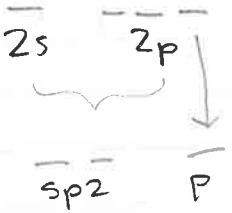
SO_3



Bent

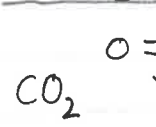
SO_2

[He] $2s^2\ 2p^6$



Two groups: AB_2 s_1p_1

linear



CO_2

CO: triple bond (can move an electron)

NO

unhappy bc N is missing an electron !!

Oxygen Resonance:

(did I use both regular and snap-on oxygens?) if yes, it has resonance.

Chapter 7 Day 2 (Sections 7.7 – 7.10) (Unit 4) 30 October 2019

1. In which of the following is the oxygen-oxygen bond predicted to be the:

   (a) shortest: O_2^{2-} O_2^- O_2 O_2^{2+}

   (b) longest: O_2^{2-} O_2^- O_2 O_2^{2+}

   (c) weakest: O_2^{2-} O_2^- O_2 O_2^{2+}

   (d) strongest: O_2^{2-} O_2^- O_2 O_2^{2+}

2. Use the 3-step approach for creating good Lewis dot structures on these molecules, each with more than one central atom. When you finish each, make sure every atom has an octet. (This is Step 4 in making good Lewis structures.)

(a) ethane, C_2H_6

(b) methylamine, CH_3NH_2

(c) methanal, CH_2O

(d) hydrazine, N_2H_4

(e) ethene, C_2H_4

3. Some molecules do not make octets. They are rare, but important. The third one has only a fleeting existence during a reaction, especially at high temperatures. We use the 3-step approach and "do the best we can". Do not exceed the octet for any of these – in other words, 7 dots is ok, 9 not so much.

(a) nitrogen trioxide

(b) chlorine dioxide

(c) methyl radical, CH_3

4. Determine if these molecules have resonance. If so, sketch all of the resonance forms.

(a) carbonate

(b) nitrite

(c) carbon dioxide

5. Assign formal charges to each atom in Questions 3a-c.

Questions in final exam format (multiple choice):

6. How many lone pairs are in the correct structure for ozone, O_3?

   A. zero B. two C. four D. six E. eight

7. What is the formal charge on sulfur in SCl_2O, in which sulfur is the central atom and obeys the octet rule?

   A. zero B. +1 C. -1 D. +2 E. -2

8. How many resonance forms does the acetate ion have?

   A. zero B. one C. two D. three E. four

Now try these problems from the book:

Section 7.7. (Radicals) Problems 11, and 12
Section 7.8. (2^{nd} row + H) Problems 13, 14, 15, 16, 36, 38,
Section 7.9. (Resonance) Problems 19, 20, 78, 80(a-c), and 98
Section 7.10. (Formal charge) Problems 21, 22, 23, 24, 94, 96, 98, 100, 104, and 106
Expanded octets (3^{rd} row and down as central atom): 8 (d, e), and 68
Practice test 10, 11, 12, 13, 14, 15.

Polar & Non-polar refer to neutral molecules

E group? It's polar usually

TABLE 8.1 Geometry Around Atoms with 2, 3, 4, 5, and 6 Charge Clouds

Number of Bonds, B	Number of Lone Pairs, E	Number of Charge Clouds	Geometry and Shape	Example
2	0	2	Linear	O=C=O
3	0	3	Trigonal planar	H₂C=O
2	1		Bent	SO₂
4	0	4	Tetrahedral	CH₄
3	1		Trigonal pyramidal	NH₃
2	2		Bent	H₂O
5	0	5	Trigonal bipyramidal	PCl₅
4	1		Seesaw	SF₄
3	2		T-shaped	ClF₃
2	3		Linear	I_3^-
6	0	6	Octahedral	SF₆
5	1		Square pyramidal	$SbCl_5^{2-}$
4	2		Square planar	XeF₄

non-polar — 2 — AB_2 — sp — 180°

non-polar — 3 — AB_3 — Trigonal planar — sp² — 120°

polar — 3 — AB_2E — Bent — sp² — 120°

non-polar — 4 — AB_4 — Tetrahedral — sp^3 — 109°

polar — 4 — AB_3E — Trigonal pyramidal — sp^3 — 109°

polar — 4 — AB_2E_2 — Bent — sp^3 — 109°

non-polar — 5 — AB_5 — Trigonal bipyramidal — 90° 120° 180°

polar — 5 — AB_4E — Seesaw — 90° 120° 180°

polar — 5 — AB_3E_2 — T-shaped — 90° 180°

non-polar! — 5 — AB_2E_3 — Linear — 180°

non-polar — 6 — AB_6 — Octahedral — 90° 180°

polar — 6 — AB_5E — Square pyramidal — 90° 180°

non-polar! — 6 — AB_4E_2 — Square planar — 90° 180°